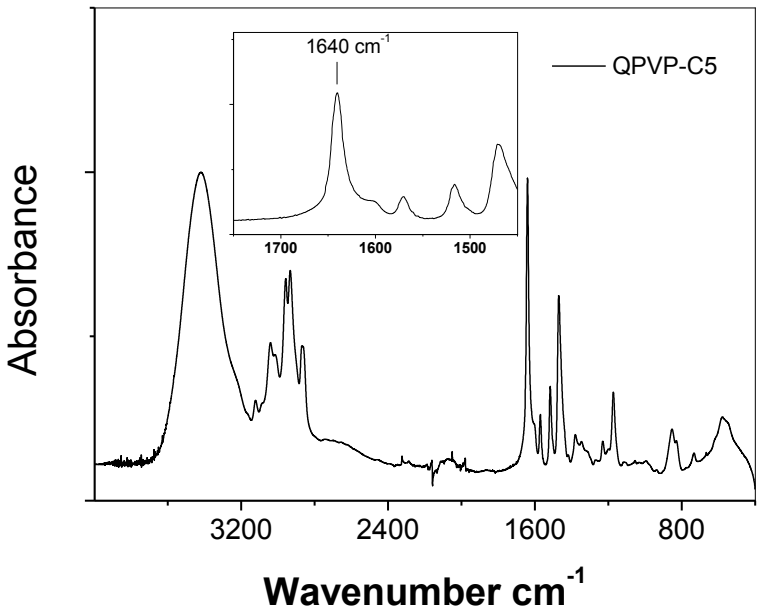
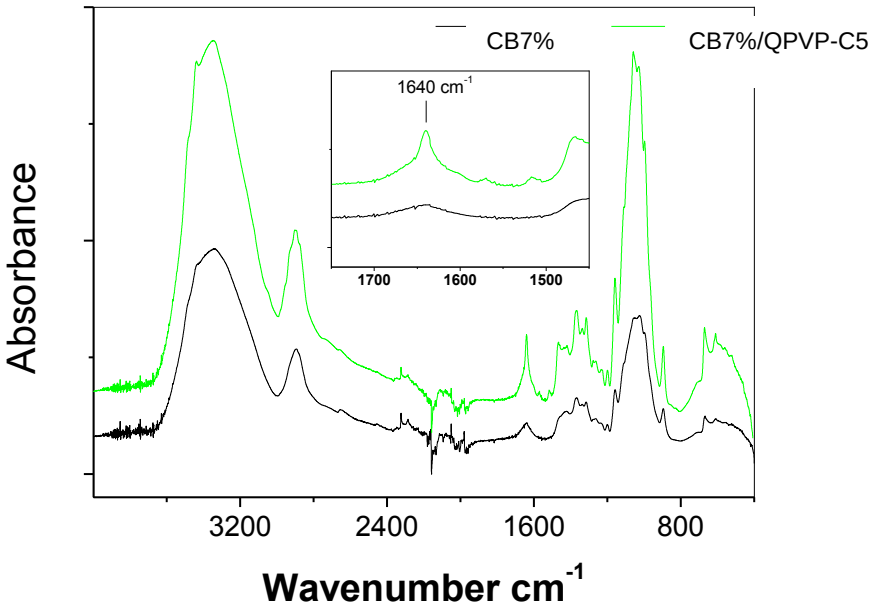
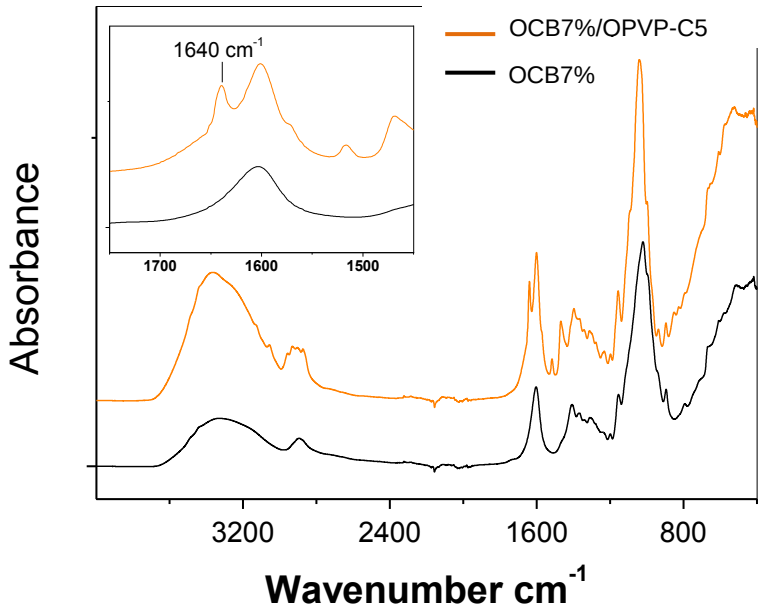
Supporting Information



(a)

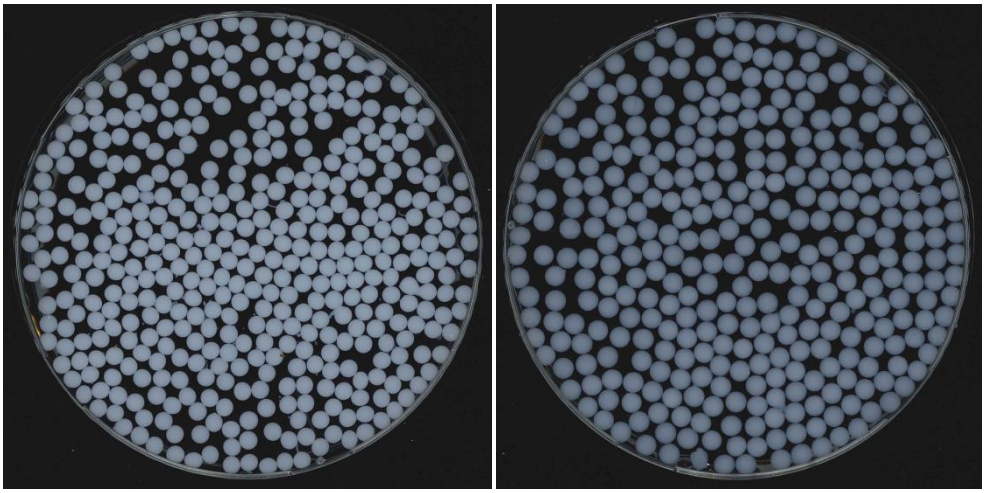


(b)



(c)

SI-1. FTIR-ATR spectra obtained for (a) QPVP-C5, (b) CB7% before and after the adsorption QPVP-C5 and (c) OCB7% before and after the adsorption QPVP-C5.



(a) (b)

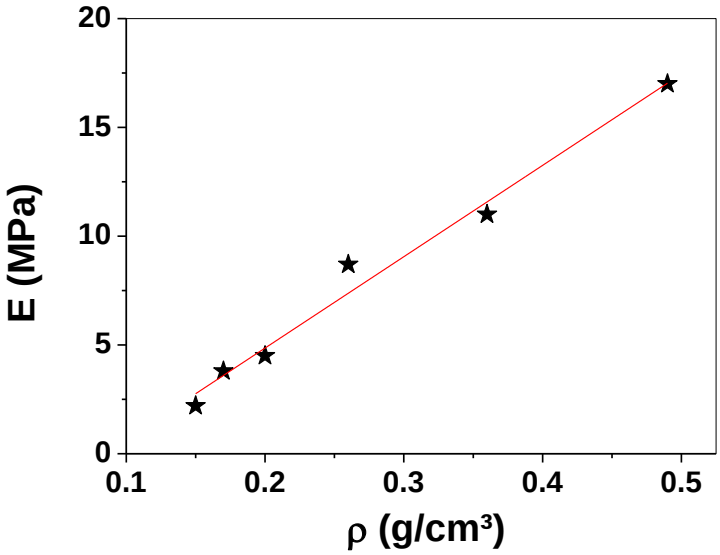
SI-2. Photographs of typical beads. (a) Images of CB7% and (b) OCB7%, respectively.

SI-3 Table 1. Characteristics of cellulose beads (CB) and oxidized cellulose beads (OCB). m_{wet}, V_{wet} and ρ_{wet} stand for mean mass of wet beads, mean volume of wet beads estimated from $Ø_{wet}$ and mean density of wet beads, respectively. The total negative charges per gram of bead were determined by conductivity titration method.

Sample	m_{wet} (mg)	V_{wet} (cm^3)	ρ_{wet} (g/cm^3)	total charges (mmol/g)
CB5%	17.8 ± 0.7	0.018 ± 0.002	1.01±0.04	0.0059 ± 0.0006
CB6%	18.7 ± 0.5	0.018 ± 0.002	1.04±0.03	0.0059 ± 0.0006
CB7%	19.1 ± 0.7	0.019 ± 0.002	0.99±0.04	0.0059 ± 0.0006
OCB5%-6h	23 ± 1	0.023 ± 0.003	0.98±0.09	0.77 ± 0.06
OCB6%-5h	26 ± 1	0.024 ± 0.003	0.99±0.08	0.50 ± 0.06
OCB6%-6h	26 ± 1	0.026 ± 0.003	0.95±0.04	0.75 ± 0.06
OCB6%-7h	-	-	-	1.02 ± 0.06
OCB7%-6h	25 ± 1	0.029 ± 0.003	0.85±0.08	0.79 ± 0.06

SI-4 Table 2. Density (ρ) and Young's modulus (**ε**) estimated for beads freeze dried in water and in tert-BuOH. The oxidized beads resulted from 6h oxidation reaction.

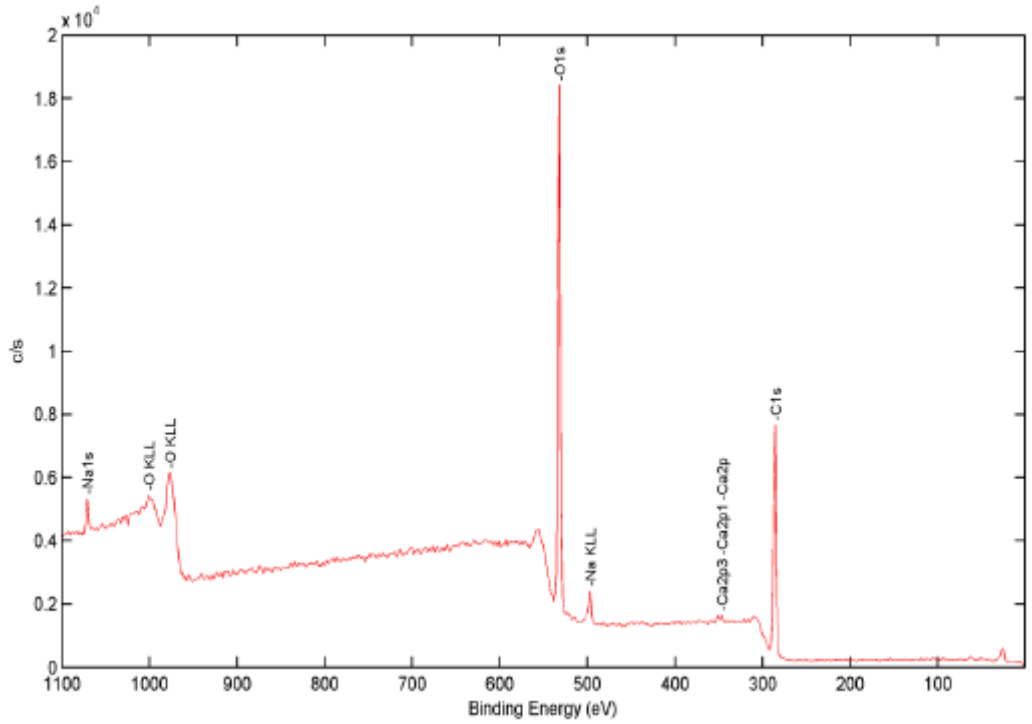
	H_2O		tert-BuOH	
Sample	**ρ (g/cm³)**	**ε (MPa)**	**ρ (g/cm³)**	**ε (MPa)**
CB5%	0.15 ± 0.04	3.7 ± 0.4	0.15 ± 0.02	2.2 ± 0.3
CB6%	0.18 ± 0.03	4.9 ± 0.5	0.17 ± 0.04	3.7 ± 0.4
CB7%	0.20 ± 0.04	5.2 ± 0.7	0.20 ± 0.03	4.5 ± 0.5
OCB5%	0.09 ± 0.04	0.49 ± 0.05	0.26 ± 0.04	8.7 ± 0.8
OCB6%	0.11 ± 0.03	0.53 ± 0.05	0.36 ± 0.05	11 ± 1
OCB7%	0.13 ± 0.03	0.59 ± 0.07	0.49 ± 0.05	17 ± 2



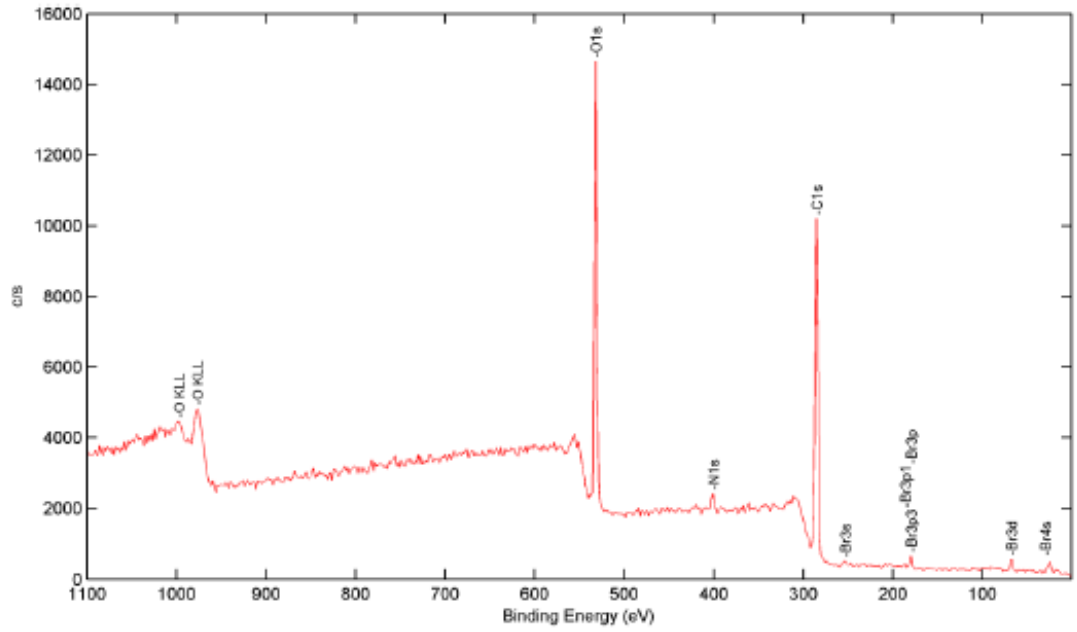
SI-5. Dependence of the Young moduli on the density determined for CB and OCB freeze-dried in tert-BuOH. The red line corresponds to the linear fit.

SI-6 Table 3. Elemental composition determined for OCB7%, OCB7%/QPVP-C5-5 and OCB7%/QPVP-C5-12.5.

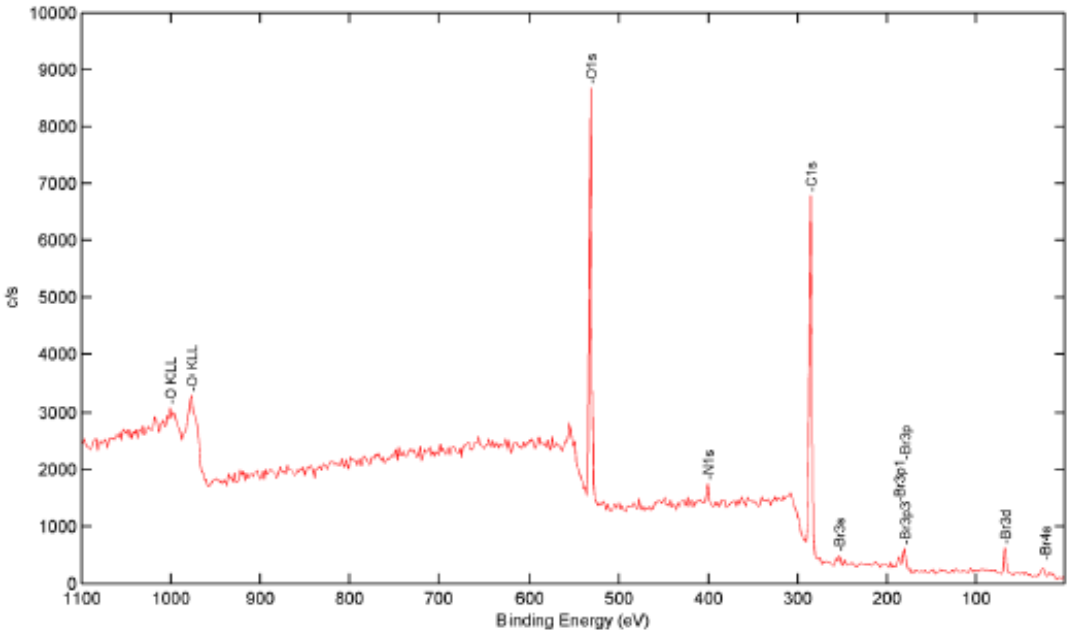
Sample	**CHN**			**XPS**		
	C (%)	H (%)	N (%)	C (%)	O (%)	N (%)
OCB7%	37.6±0.1	6.6±0.2	0	53.6	44.6	0
OCB7%/QPVP-C5-5	41.0±0.5	6.7±0.2	0.7±0.1	66.0	31.5	2.1
OCB7%/QPVP-C5-12.5	44.2±0.6	6.9±0.1	1.7±0.1	72.1	22.4	4.1


x 10^4
c/s
Binding Energy (eV)
-Na1s
-O KLL
-O KLL
-O1s
-Na KLL
-Ca2p3 -Ca2p1 -Ca2p
-C1s

(a)


c/s
Binding Energy (eV)
-O KLL
-O KLL
-O1s
-N1s
-C1s
-Br3s
-Br3p3 -Br3p1 -Br3p
-Br3d
-Br4s

(b)



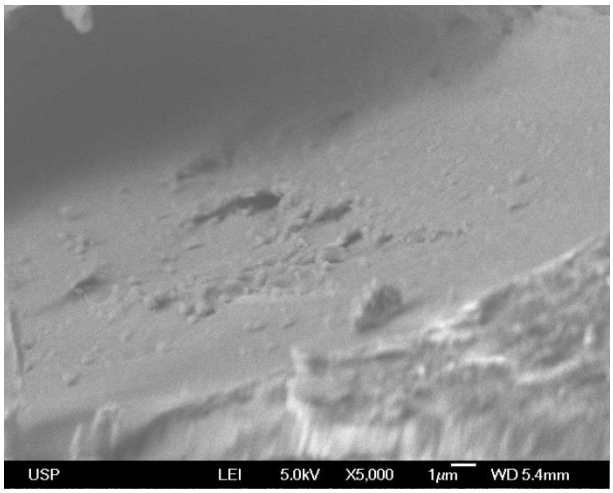
(c)

	Survey						High resolution C 1s			
Sample	C %	O %	N %	Traces	O/C	N/C	C1	C2	C3	C4
a	53.60	44.57	0.00	Na, Ca	0.83	0.00	18.58	56.30	20.70	4.43
b	66.03	31.48	2.07	Na, Br	0.48	0.03	45.96	43.64	9.97	0.44
c	72.08	22.40	4.06	Na, Ca, Br	0.31	0.06	28.09	57.90	11.98	2.04

SI-7. XPS spectra obtained for (a) OCB7%, (b) OCB7%/QPVP-C5-5 and (c) OCB7%/QPVP-C5-12.5, with the corresponding elemental data.

SI-8 Table 4. Relative decrease of turbidity (**Δτ**, %) measured for dispersions of *M. luteus* after 24h contact with OCB7%, OCB7%/QPVP-C5-5 and OCB7%/QPVP-C5-12.5 and P elemental analysis of beads post biocide assay. The data are mean values obtained for three different sets of the same system with the corresponding standard deviations.

Samples	**Δτ (%)**	**Phosphorus P (ppm)**
M. luteus	23±2	-
OCB7%	65±3	252±17
OCB7%/QPVP-C5-5	85±1	559±11
OCB7%/QPVP-C5-12.5	99±1	353±16



SI-9. Typical SEM image obtained from the interior of OCB7%/QPVP-C5-12.5 after interacting 24h with bacteria.